

## CHAPTER 5

### SUMMARY & RECOMMENDATIONS

The overall goal of the SPS study was to provide comprehensive baseline information on stream conditions in Fairfax County through biological and physical habitat assessments, and based on these results, assign priorities for watershed management. This overall goal and the purpose for the study were achieved.

In summary, this SPS Baseline Study achieved the following:

- Enabled Fairfax County staff and the public to have a better understanding of the degree of stream degradation in the County.
- Established Watershed Management Categories that outlined strategies and measures that, if implemented, could be effective in reversing the negative trends of stream degradation and the protection of stream resources.
- Identified areas to be treated on a priority basis for the allocation of resources toward development of comprehensive watershed master plans.
- Demonstrated how SPS supports and integrates with other ongoing and future environmental policies, initiatives and regulations.
- Provided a basis for moving ahead with implementation of stream restoration and preservation efforts and assessing future conditions of County streams.
- Established working partnerships with citizens and provided the basis for continual environmental stewardship by supporting other monitoring efforts.

The methods and detailed results of the study were presented in Chapters 2 and 3. Priorities and recommendations for watershed management were presented in Chapter 4. This chapter provides a summary of the results and presents recommendations for future work to achieve and enhance water quality goals.

Streams within Fairfax County exhibit a diverse range of conditions. While field monitoring isolated numerous systems with high biological and habitat quality, it also highlighted many areas where substantial degradation has taken place (Figures 5, 6, and 7). Levels of drainage imperviousness are known to influence stream condition, and spatial analyses of land cover characteristics indicate that a large percentage of County watersheds currently have imperviousness levels that are within or above the range (10 – 20%) at which biological impairment is generally accepted to occur. (Figure 8).

The systems of high integrity that still exist within the County's boundaries are typically found only in largely undeveloped watersheds. Conversely, the most degraded streams are those that flow through areas of the most intensive development (Figure 10). This pattern is even more pronounced in drainages containing older developments that often lack the more recently developed and more efficient stormwater controls.

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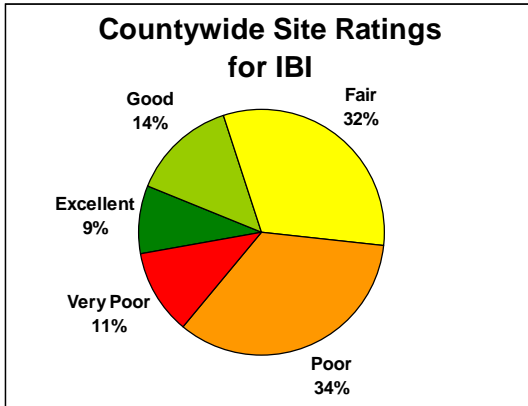


Figure 5. Percentage of SPS monitoring sites scoring in each of the five IBI quality categories.

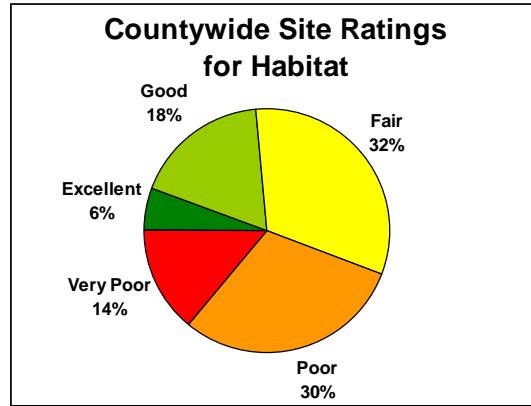


Figure 6. Percentage of SPS monitoring sites scoring in each of the five Habitat quality categories.

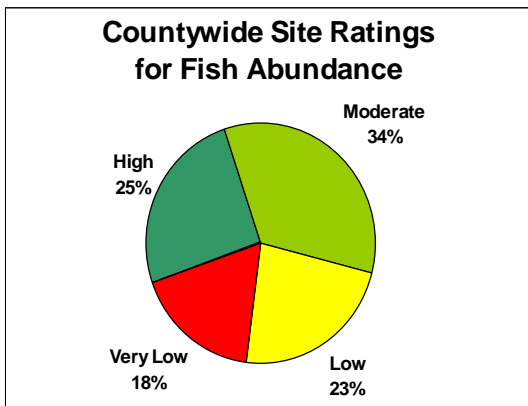


Figure 7. Percentage of SPS monitoring sites scoring in each of the four Fish abundance categories.

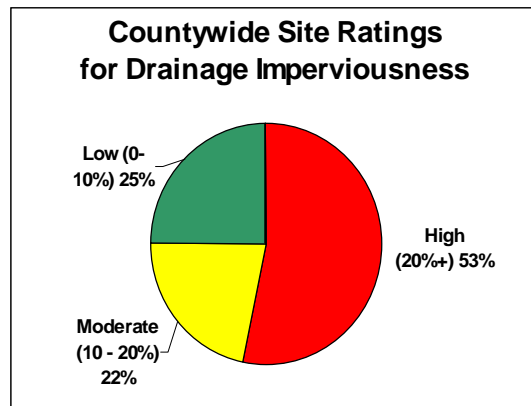


Figure 8. Distribution of Imperviousness at SPS monitoring sites.

The impact of land alteration on aquatic systems within the County is twofold: (1) widespread instream habitat degradation from channel incision and widening caused by high storm flows and (2) excessive sediment loading (with the associated high levels of deposition) from instream erosion and sometimes poorly installed and/or maintained controls at construction sites.

Consistent with what has been reported in the literature (Klein, 1979, Booth, 1991, Schueler et al, 1992, Booth et al, 1993, Booth and Jackson, 1994 and Boward et al, 1999) this study showed a statistically significant relationship between drainage area, imperviousness and biological quality at a site (see Appendix B for details on the statistical analyses). Figure 9 shows the relationship between biological integrity and drainage area imperviousness. The trend line shown in the figure is presented to highlight the fact that impervious area generated during development is correlated with declining stream quality as measured by macroinvertebrate community health. However, the relationship in its current form (linear) should not be used for predictive purposes since that would require a more detailed statistical analysis.

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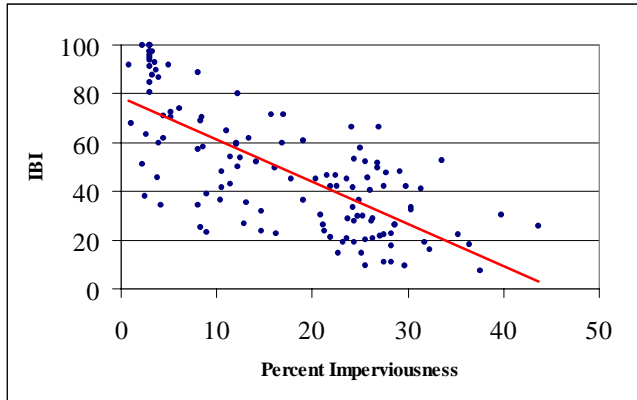


Figure 9. Trend line indicating that Biological integrity, as measured by an Index of Biotic Integrity (IBI) for benthic macroinvertebrates, generally decreases with increasing percent imperviousness. Appendix B includes information on the statistical significance of the data presented.

To address the many issues of stream quality, an innovative approach will be needed, with the SPS program as the cornerstone. The County has already begun the process by improving the existing erosion and sediment inspection program, updating and enhancing the EQC policy and enforcing existing environmental regulations. These changes must continue with an attitude shift toward viewing streams as important natural resources and functioning ecosystems. Many new technologies are available in the field of stormwater management and bioengineering, which can be used to eliminate or substantially limit the impact of development on adjacent aquatic systems.

The goal of protecting and restoring stream quality is an achievable one, but the key to success will be found only in a diverse approach which includes an active and ongoing stream monitoring effort, community education, improving stormwater controls, and enhanced channels of communication with site developers. The SPS program is but one component of the larger effort that will be needed, but its initial creation and subsequent integration with many other existing programs is a vital first step.

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# Countywide Conditions

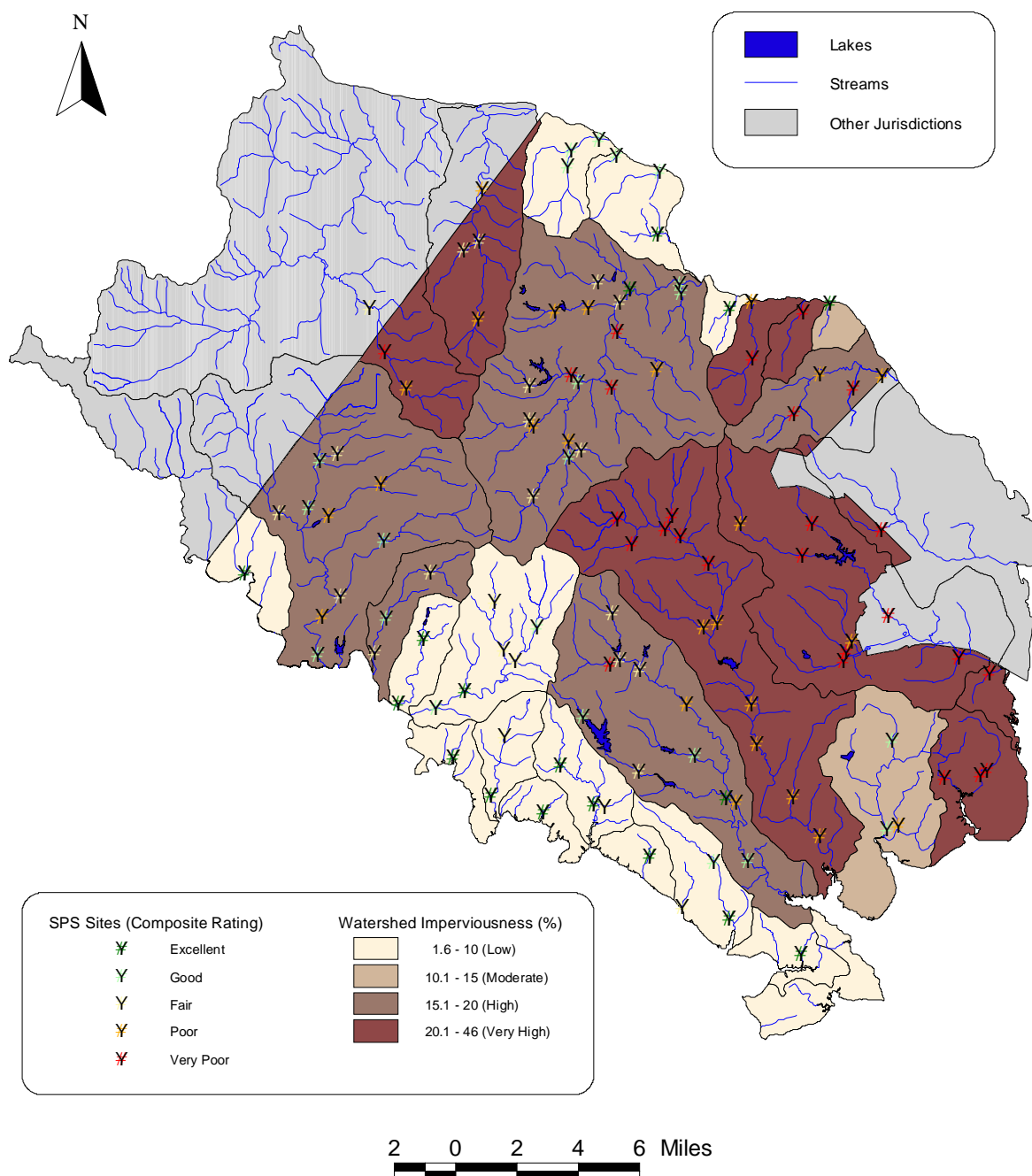


Figure 10. Relationship between imperviousness and overall stream condition.

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This baseline study identifies and prioritizes areas with the greatest needs, and creates a foundation for implementing targeted monitoring and remediation efforts in the future. The recommended management classifications are each characterized by a set of goals and strategies that best suits each respective environment given our current level of understanding. The overall objective is to recommend measures to protect the highest quality streams and actively restore degraded streams to the most practical extent possible. The management categories are as follows:

### **Watershed Protection (31.5% of County)**

*Primary goal:* Preserve biological integrity by taking measures to identify and protect, to the extent possible, the conditions responsible for current high quality rating of these streams. Watershed Protection Areas have the highest priority and require immediate attention to assure their current biological integrity is maintained.

### **Watershed Restoration Level I (7.2% of County)**

*Primary Goal:* Re-establish healthy biological communities, where feasible, by taking measures to identify and remedy the cause(s) of stream degradation both broad scale and site specific. Watershed Restoration Level I Areas have the greatest opportunity for improvement based on current conditions and proposed development. Restoration plans should be developed and implemented for these watersheds first.

### **Watershed Restoration Level II (61.3% of County)**

*Primary Goal:* Maintain areas to prevent further degradation and implement measures to improve water quality to comply with Chesapeake Bay Initiatives, Total Maximum Daily Load (TMDL) regulations and other water quality initiatives and standards. Areas designated as Watershed Restoration Level II will need to be prioritized based on stream order (headwater vs. mainstem), current and potential development, existing improvement projects, regulatory requirements and other initiatives.

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## FUTURE ASSESSMENT

The results in this report are only intended to provide a snapshot of stream quality conditions as they exist today. As such, this baseline study should be seen only as the beginning phase of the permanent monitoring effort that will be needed for effective management of aquatic resources within the County. If appropriate decisions are to be made, trends in stream conditions will need to be identified and assessed over the long term. This will require expanding our base of understanding of streams, and components of any future SPS program should involve:

- Expanding analyses of existing spatial data sets
- Continuing to monitor existing SPS sites on a rotating basis
- Establishing a detailed visual assessment program at the subwatershed level
- Assessing variables influencing fish community composition and distribution
- Promoting the expansion of volunteer monitoring efforts
- Defining and identifying perennial stream networks within the County
- Assessing relative contribution of various sources of instream sediment
- Evaluating alternate site selection design to allow for more rigorous analyses
- Assisting with assessments of effectiveness of various BMP technologies
- Monitoring changes in imperviousness at the watershed and subwatershed levels
- Improving inter-agency cooperation regarding sediment control implementation and maintenance
- Fostering community interest in stream quality issues.

### ***Spatial Analysis***

Assessments of the relationship between land use and stream condition should be expanded to include other variables. Specifically, comparisons should be made between current site composite ratings and percent forest cover, proximity to upstream impoundments, extent of parkland and Resource Protection Areas, and age of development. Each of these examinations should be made with respect to the contributing drainage area of each SPS monitoring location.

### ***Long Term Monitoring***

All environmental monitoring relies on repeated observation to provide the most complete picture of environmental processes. In this vein, all County watersheds should be re-sampled in coming years to both highlight changes in conditions as well as develop a broader information base. Identification of ongoing trends, both on a large- and small-scale, will provide a basis for targeting management activities in the future. Annual re-sampling should include at least 20 – 25% of SPS sites each year. Areas of priority concern (i.e., those potentially reaching a threshold for integrity) should be

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reassessed first and more frequently, potentially with an expansion of monitoring efforts within the respective subwatersheds.

### ***Visual Assessments***

Given the limited scope of this initial baseline study, many questions remain as to the actual extent of degradation within many watersheds. As a first step, County streams should be walked in full to identify areas of both large- and small-scale concern and to better understand factors influencing basin-wide patterns in stream condition. Such efforts would also be useful in highlighting otherwise undiscovered problems where property or other infrastructure requires maintenance or repair. Site-specific information should be collected using a GPS unit for use within a GIS environment. Given the amount of time required to complete such a task within all of the County's watersheds, areas of priority concern should be targeted first. This effort could be integrated with a comprehensive watershed master planning effort.

### ***Fish Community Metrics***

Many questions remain regarding fish communities in many County watersheds. Specifically, further study is needed of the factors influencing measures of relative abundance, composition, and distribution, with an eye toward developing a useful suite of metrics for broad-scale comparisons. Of specific concern are the compounding effects of instream fish barriers, stocking efforts, and the relative proximity of large rivers systems. Impoundments should also be assessed with regard to their impact on fish movement as well as their influence on stream temperature, sediment load, and nutrient content.

### ***Volunteer Monitoring Efforts***

Subwatersheds designated within this report as Assessment Priority Areas should be a primary focus of future biological sampling efforts. The expansion of the volunteer monitoring program, with the help of the NVSWCD and ANS, would be of great benefit in this regard. Reliable volunteer data could be used to help develop a broader information base, particularly in areas of priority concern where more detailed examinations are warranted. It is also recommended that volunteers receive training in identifying possible violations of County E&S regulations. Broader involvement of citizen volunteer monitors could promote greater environmental stewardship, heighten public awareness and provide support for public education.

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### ***Stream Network Assessment***

Perennial or “permanent” streams within the County were identified based upon the USGS 1:24,000 topographic maps, a standard source used by many resource management agencies at the federal, state, and local levels. It has been argued, however, that the resulting coverage is incomplete and inaccurate and that a more rigorous definition needs to be developed. Once this criteria is established, perennial streams within the County could be identified and inventoried as part of the ongoing visual assessment efforts detailed above. This would again require the use of GPS units so that the resulting information could be incorporated as part of land use analyses within a GIS environment. In this process, it is also recommended that the many unnamed tributary systems found in all watersheds be given title designations, a process that would allow for better referencing and serve to enhance citizen identification and ownership of streams.

### ***Instream Sediment Studies***

Since sediment is a serious pollutant in County streams, pilot studies should be undertaken to determine the relative contribution of specific sources (i.e., instream erosion versus site development) and to look at ways to mitigate the associated degradation. As an important step toward better voluntary compliance with the Chesapeake 2000 Agreement, attempts should also be made to quantify sediment loads leaving County streams. Any stream restoration activities will also require better estimates of current rates of erosion and bend migration to ensure viability. Controlling the amount of stream sediment loading must be a major priority for the SPS as well as other County environmental programs, particularly in light of recent issues surrounding the intake system for the Potomac River water supply. Additional training in stream classification and morphological assessment methodology is recommended for all County personnel with a stake in affecting stream restoration.

### ***Study Designs Modifications***

A re-evaluation of current SPS study site placement is recommended. Other, more statistically rigorous alternatives may be useful in allowing for more detailed analysis of data collected in the future. Specifically, the use of a more randomized sampling design would allow for more direct comparison of site characteristics both within stream orders and between subwatersheds and physiographic regions.

### ***Stormwater Control Effectiveness***

Assessments of new BMP technologies should be an ongoing process as recommended by the recent draft of the Infill and Residential Development Study. Detailed cost-benefit analyses and a better overall understanding of their applicability



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within Fairfax County is needed. Both pre- and post-implementation monitoring should be conducted to determine overall effectiveness of various designs.

### ***Impervious Cover Estimation***

As a primary component of the overall ranking system detailed in this report, levels of imperviousness within all County watersheds will need to be regularly reassessed and compared with the results of subsequent biological habitat monitoring. Efforts should also be made to develop applications within a GIS environment to automate, as much as possible, the detailed, multi-step processes (point delineation, clipping of land use coverages, tabulation of areas) that are necessary to develop impervious cover estimates. This could be used to further refine the relationship of imperviousness to biological integrity of County watersheds. GIS will likely play an increasingly significant role in the future.

### ***Wetland Monitoring***

Methods for monitoring coastal wetland areas with variable drainages, such as the entire High Point Watershed, will need to be developed. These areas cannot currently be sampled under the RBP protocol, which requires clearly defined stream systems. The value of various indicators, such as macroinvertebrates, amphibians, and even plants, will need to be assessed with regard to their utility in highlighting degradation in wetland environments.

SPS monitoring can be incorporated into the new countywide wetland delineation and evaluation study currently being undertaken jointly with George Mason University personnel.

### ***Inter-Agency Cooperation***

With regard to monitoring for and responding to violations of E&S regulations at sites under development, SPS should work to strengthen its relationship with the Office of Site Inspection. Cross training of staff from both agencies should be encouraged.

### ***Promoting Public Awareness***

A major goal of the SPS program has been and will continue to be increasing community involvement and awareness in water resource issues. To this end, further developments of the SPS site on the World Wide Web are needed. This should include adding summaries of the information detailed in this current report, as well as periodic updates on monitoring efforts and management activities aimed at restoration and overall stream quality improvement. It is also recommended to develop an online GIS server, which would enable County residents to obtain information on stream health in their own neighborhoods on a continual basis.